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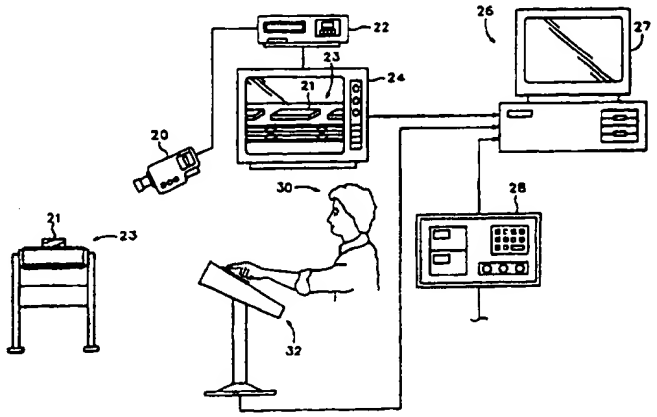

(57) Abstract

Using the paced iterative decision training system and method, a grader (30) is presented a series of paced events (52) for the grader (30) to judge so that the grader's recorded assessment of the events are compared to a separate recorded assessment of the same events (54). The separate recorded assessment may be created by a master grader or by the grader (30). The system and method provides a simulated environnemnt in which a grader's decision making skills can be tested and improved. Preferably, the system and method record a video of traveling pieces of lumber (21) using a camera (20) and video tape recorder/player (VTR/P) (22). An event detector (28) detects each piece of lumber (21) such that one piece of lumber (21) is graded per events. A computer controller (26) is able to determine the timing of each event based on synchronization (frame) signals from the VTR/P (22), and event signal from the event detector (28). The resulting video may be shown to a master grader, who grades each piece of lumber as it passes by on the video monitor (24). To learn how properly to grade or judge lumber (21), a trainee (30) sits at a grade entry station while a training program is replayed. The trainee (30) grades each piece of lumber (21) as it passes through the video frame. Later, the trainee's grading is compared to the master grader's baseline grading. The net result of the system and method is a faster, less expensive method of training a trainee (30) than previously available.

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PACED ITERATIVE DECISION TRAINING SYSTEM AND METHOD

Technical Field

This invention relates generally to training systems and methods. More particularly, this invention relates to educational and/or vocational training systems and methods for improving the paced iterative decision-making ability of person who is required to make quick assessments of changing events. Although the invention has broad utility, it has proven especially well suited for use in the context of a lumber grading/sorting training system and method.

Background Art

Many occupations and activities require quick and decisive evaluations of given events or a series of given events. Unfortunately, before a worker can consistently make the proper evaluations of such events, the worker must have experience. However, traditional training systems and methods for providing the necessary experience are ineffective and/or expensive. These traditional systems and methods may include text books, work books, pop quizzes, written examinations, oral examinations, class presentations, hands-on demonstrations, lectures, flash cards, field trips, factory tours, and laboratory experiments. While these are valuable and useful pedagogic tools, they are insufficient when it comes to developing a person's skill for making quick and accurate decisions.

Traditionally, the best methods and systems for developing these skills are analogous to teaching a student to swim by throwing the student into the water at the deep end. A student is placed into the role of a decision-maker within an actual work environment. The student's decisions are reviewed by an instructor who corrects the student's mistakes. The student learns from the student's mistakes so that the student may perform better next time.

Disadvantages of such traditional training methods and systems is the expense of training a student in an operating work environment. It is expensive because the student is likely to make many errors that must be corrected. This activity reduces productivity and may lead to unnecessary safety and quality concerns. A training system and method is needed in which a student has the opportunity to learn and gain valuable

experience without working in an actual work environment and unnecessarily risking safety and quality.

Examples of occupations and activities that require a quick and honed decision-making ability include a fish counter and a lumber grader. A fish counter identifies and counts the various species of fish that pass through a dam. A lumber grader determines the quality or grade of a piece of lumber as it travels past the grader at a grading station.

Lumber is sorted based on the quality or grade determined by the grader upon visual inspection of the lumber as it travels past a grading station. The price at which the lumber may be sold is at least in part based on the grade assigned by the grader. Grading lumber takes a high degree of skill and experience. Unfortunately, existing ways to train a novice grader are costly and time consuming.

Lumber grading systems exist that help improve the quality of lumber grading by rotating the piece of lumber so that the grader can see all sides of it before giving it a grade (such as U.S. Patent No. 3,759,384 to Holmberg et al.). However, no cost-effective training system exists to help new and existing graders gain valuable experience and thus, improve the overall quality of lumber grading. Since the quality of lumber grading is ultimately dependent upon the skill of the grader, a cost-effective training system and method is needed to help train new graders and hone the skill of experienced graders.

Disclosure of the Invention

The invented training system and method solves the aforementioned problems by introduction of a simulation of a series of events for a person to grade and a means of recording the grade of each event in the series for comparison to one or more person's grades of the same series of events. In the invented training system and method, a grader is presented a series of paced events for the grader to judge. The grader's recorded assessment of the events are compared to a separate recorded assessment of the same events by the same or different grader. The separate recorded assessment may be created by an master grader or by the same grader. A purpose of the training system and method is to provide a simulated environment in which a grader's decision-making skills can be tested and improved. Typically, expert feedback is utilized to improve the novice grader's ability to assess, evaluate, judge or grade each event in a series events. A comparison of the

novice grader's assessment to a master grader's assessment of the same series of events provides the expert feedback needed for the appropriate pedagogic effect.

The invented training system and method has a potentially wide application. It is preferably designed to help train lumber graders in a lumber sorting system. The training system and method reduces the time and expense required to train a novice grader. The training system and method records a video of traveling pieces of lumber on a conveyor system using a camera and video tape recorder/player (VTR/P), which may be coupled to a monitor. An event detector detects each piece of lumber so that one piece of lumber is graded per event. A computer controller determines the timing of each event based on synchronization (frame) signals from the VTR/P and an event signal from the event detector. The resulting video and recorded event information is an event-simulation (or simply a simulation).

Preferably, the simulation is shown to a master grader in association with a computer controller. The master grader sits at a grade entry station (GES) and grades the pieces of lumber that pass by on the video monitor. Each event is graded by the master grader and each event-associated grade is stored to produce a grade dataset. The simulation and the associated dataset is a training program.

To learn how properly to grade or judge lumber, a trainee sits at a grade entry station while a training program is replayed. The trainee grades each piece of lumber as it passes through the video frame. Later, the trainee's grading is compared to the master grader's baseline grading. This process can be repeated with the same or different training programs as many times as desired. The net result of the system and method is a faster, less expensive method of training a trainee than previously available.

These and other advantages and objects of the present invention will be more readily understood after a consideration of the drawings and the detailed description of the preferred embodiment which follows.

Brief Description of the Drawings

Fig. 1 is a general schematic block diagram a training system, constructed in accordance with a preferred embodiment.

Fig. 2 is a schematic diagram of the training system of Fig. 1 showing the components used to record a video of a series of events.

Fig. 3 is a schematic diagram of the training system of Fig. 1 showing the components used to present a video of a series of events and record the grader's evaluation of each event.

Fig. 4 is a flow chart of a training method, in accordance with a preferred embodiments.

Detailed Description of the Drawings, Preferred Embodiment, and Best Mode for Carrying Out the Invention

Although the preferred embodiment for the invention is described in the context of a lumber grading training system and method, those who are skilled in the art will understand and appreciate that the invention has a potentially wide application to any educational and/or vocational training system or method. The training system, in accordance with a preferred embodiment, is generally shown at 10 in Fig. 1. In general, the training system includes an event-simulation subsystem 12, a presentation-and-entry subsystem 14 and a controller 16.

Event-simulation subsystem 12 creates, produces and/or records any sequence of events (i.e., series of events) for playback later to a user of presentation-and-entry subsystem 14. An "event" is any action or thing that occurs during a particular interval of time and a "series of events" is any sequence or succession of events. For example, a series of events may include pieces of lumber on a conveyance system, fish passing through a dam, etc. An event has characteristics (i.e., properties, qualities, etc.) that are capable of being objectively and/or subjectively determined by a person. A person's evaluation of the characteristics of a piece of lumber is the piece's "grade". For fish passing through a dam, a person may quickly count the approximate number of fish of specific species passing through during a short time interval. Preferably, the simulation created by event-simulation subsystem 12 is a video recording of an actual series of events. Alternatively, the simulation may be an animation (hand-drawn or computer-generated), slide show, virtual reality, etc. The event-simulation subsystem preferably includes a video camera, a VTR/P, a video monitor, and an event detector.

Presentation-and-entry subsystem 14 receives the simulation from the event-simulation subsystem and presents it to the user. The user views the simulation and

enters a grade for each event. The presentation-and-entry subsystem preferably includes a video monitor, a VTR/P, and a grade entry station.

Controller 16 coordinates and controls the event-simulation subsystem and the presentation-and-entry subsystem. The controller distinguishes between individual events based on a signal from an event detector. It also associates and stores the user's grades with the proper events. After two or more evaluations of the same simulation, the controller compares the evaluations and reports the results. Preferably, the controller includes a computer (with a processor and memory/storage systems) and a display.

Figs. 2 and 3 show the preferred embodiment of the training system in more detail than shown in Fig. 1. The preferred embodiment of the training system and method operates in two basic modes: production mode and grading mode.

Fig. 2 shows the training system in the production mode. When operated in the production mode, the preferred embodiment of the invention includes a high resolution video camera 20 and a video tape recorder/player (VTR/P 22) which collectively record video images of pieces 21 of lumber on a conveyer system 23 as they travel seriatim past a grader 30. A video monitor 24 may be attached to the VTR/P. In Fig. 2, monitor 24 shows an example of one frame of the video tape being recorded on the VTR/P. The monitor shows pieces 21 of lumber on conveyer system 23. While taping, the VTR/P sends frame information to computer 26. The computer may have display 27 attached thereto. In the preferred embodiment, no video images are stored on the computer.

It is necessary to determine when each event takes places so that the events may be graded individually. In the preferred embodiment, each event is piece 21 of lumber travelling seriatim (i.e., one-after-another) by conveyance system 23. An event detector 28 (preferably, in the form of a programmable logic circuit (PLC)) detects and determines when a new piece of lumber may be graded and sends an event signal to computer 26. Event detector 28 is used to provide grade zone timing definition (an event signal) to the computer 26. The event timing signal is to be provided from the conveyance system 23 controller (typically a discrete output from a PLC) which signals when a new piece of lumber has been presented for grade inspection to the grader 30. The pairing of the event timing signal for grade entry coupled with the VTR/P frame information provides synchronization of the board video image and its associated dataset which is stored by the

computer 26. Based on the event signal sent by PLC 28 and the frame information sent by VTR/P 22, computer 26 determines when each event occurs. The frame and event information is stored in the computers primary and/or secondary memory systems. For example, frames 90-150 may be a first event, frames 151-209 may be a second event, frames 210-275 may be a third event, and so forth.

The resulting combination of the video tape of the series of events and the frame and event information stored on the computer is called a simulation program. A simulation program may last any given length of time. Preferably, a sixty to ninety minute program is used to help train lumber graders.

Fig. 2 also shows a grader 30 using grade entry station (GES) 32 or any other data entry station. The grader and GES is not necessary for the production mode; however, the production mode and grading mode may occur concurrently. Thus, the grader may view and grade the pieces of lumber on the conveyer system while a simulation program is being produced using the same pieces of lumber. The grader's grade may be associated with each event as it occurs.

Fig. 3 shows the training system in the grading mode. Grader 30 using grade entry station 32, views a simulation program on video monitor 24. The video on the video monitor is produced by VTR/P 22. The VTR/P sends a signal to computer 26 that include frame information on the simulation program being viewed by the grader.

Each event (i.e., pieces of lumber) is presented to the grader at paced, defined time intervals. This means that the time intervals have a defined (i.e., pre-selected) length and are separate from each other. There should be little or no overlap between time intervals for events. In the preferred embodiment, the interval of time for each event is generally the same. Typically, the time interval in which each piece of lumber is presented to the grader for grading will vary according to the speed capabilities of the conveyance system as well as the desired visual inspection grading rates. In lumber grading applications this timing interval is typically between .5 to 1.0 seconds for each board event. Also, the GES sends a signal to the computer indicating the grade designated and entered by the grader. Based on the frame information sent by the VTR/P and the stored associated frame and event information, the computer associates the grader's grade with each event of the simulation program.

Preferably, the computer is an IBM-compatible computer with a primary memory system (i.e., RAM) and secondary memory systems (e.g., floppy and hard disk drives). The computer also preferably includes a KIETHLEY METRABYTE 96 port I/O (input/output) card. Grade entry station 32 and PLC 28 are connected to the computer via this I/O card.

In lumber sorting systems, there are two common means of entering a grade for a piece of lumber. The first means is depicted in Fig. 3 and to some extent in Fig. 2. The grader mans a GES and pushes buttons that indicate the grade of the piece of lumber that the grader is viewing. The GES is typically a keyboard similar the GES 32 shown in Figs. 2 and 3. The other common grade-entry means is where the grader personally turns over each piece of lumber to inspect it closely. Once the grader determines the piece's grade, the grader writes the grade on the piece itself. The grade is optically scanned into a computer so that the piece may be properly sorted.

The preferred embodiment may utilize the both common grade-entry means. The first has been discussed above. Alternatively, the second common grade entry system of personal inspection and hand writing the grade may be utilized. The grader enters the grade of each piece by using a tablet entry system. GES 32 would include a tablet entry system on which the grader's writes symbols indicating specific grades. The GES and/or the computer translates the grader's written symbols into grades that can be stored in the dataset.

When the training system is in the grading mode, a grader views a program and grades each event to produce a dataset. Preferably, the dataset includes the grader's grade of each event in the program. Once at least two datasets are created for a program, they may be compared. The computer compares the datasets and the results are stored in the computer and preferably displayed on display 27.

The compared datasets may be created by the same grader or by different graders. When training a novice grader (i.e., trainee), it is desirable to use a master grader to create a master or baseline dataset for the simulation program. The trainee can learn from the trainee's mistakes by viewing a report on the differences between the trainee's dataset and the master dataset. From such comparison, the trainee can learn how to grade better by examining how his evaluation of the events compares to a master grader's

evaluation of the same events. Also, this system may be used by a single grader multiple times. A grader may improve consistency in grading by comparing the grader's evaluation of the same events.

In Fig. 4, the preferred embodiment of the invented training method is shown. The method starts at 50. At 52, the grader is first presented a series of events. At 54, the grader first evaluates the characteristics of each event. At 56, the grader first enters such evaluations. At 58, the grader's evaluations of each event of the series are first stored, thereby producing a first dataset. The resulting first dataset is shown at 59.

At 60, the training method determines whether a second dataset exists. If so, the first and second datasets are compared at 70. Otherwise, a second dataset must be created; therefore, at 62, a second presentation of a series of events is given to the same or different grader. At 64, the grader does a second evaluation of the characteristics of each event of the same series of events. At 66, the grader does a second entering of such evaluations. At 68, the grader's evaluations are stored to produce a second dataset. The second dataset is shown at 69. At 60, the answer to the whether a second dataset exist must be "yes" because a second dataset was created in steps 62-68. Next at 70, the first and second datasets are compared. At 72, information based on the results based on such comparisons is reported and such report may include storing the information for later retrieval. The training method ends at 74.

Of course, those who are skilled in the art understand and appreciate that the description above describes the preferred embodiment and the drawing and does not limit the spirit and scope of the invention. Other possible alternative embodiments exists. For example, rather can video taping actual events to produce the simulation, a computer can create a virtual reality (VR) environment. Using a VR scenario, the user would don a VR helmet and glove. The user would see computer-generated three-dimensional images of events (such as pieces of lumber) and the GES. A computer would determine which virtual button the user was pressing to indicate the grade of the event. The VR scenario is only given as an example, but other possible modifications may be made without departing from the soul and breadth of the invention.

Industrial Applicability

The invented training method and system now may be understood to provide a method and system for training a grader to develop and improve the grader's ability to make decisions and evaluations under the pressure of time. Those who are skilled in the art will understand and appreciate that the invention has a potentially wide application to any educational and/or vocational training system or method.

Examples of training scenarios in which the invention is an appropriate and cost-effective training system and method include: grading pieces of lumber; grading pieces of wood veneer; counting fish passing through a dam; grading the quality of finished or processed goods on an assembly line; grading the quality of raw products before entering a processing/assembly line; examining x-rays of luggage at security check points; examining medical test results; reviewing plays from sporting activities to judge the proper foul or penalty to call; reviewing plays in football games to determine the proper offensive or defensive audible; and any perception/observation testing.

While the preferred embodiment and best mode of the invention have been disclosed, variations and changes may be made without departing from the spirit and scope of the invention.

WE CLAIM:

1. A paced iterative decision training method for improving a user's decision-making ability, the method comprising:

presenting a first event to a user for a preselected time interval;

accepting a first decision by a user regarding one or more characteristics of the first event, such that the first decision is made substantially within the defined time interval that the first event is presented;

accepting a second decision by a user regarding one or more characteristics of the same first event, such that the second decision is also made substantially within the time interval that the first event is presented;

comparing the first and the second decisions; and

reporting the results of the comparing step to the user as a way of improving the user's decision-making ability.

2. The method of claim 1 further comprising repeating said presenting, said accepting a first decision, said accepting a second decision, said comparing and said reporting steps for each event in a series of events.

3. A paced iterative decision training method comprising:

first presenting of a series of events at paced, defined time intervals;

first evaluating characteristics of each event of the series to produce an evaluation of each event;

first entering such evaluations at a data entry station;

first storing such evaluations entered at the data entry station to produce a first dataset which is associated with the series of events;

comparing such first dataset with a second dataset, wherein the second dataset includes evaluations of the same series of events; and

reporting information based on results of said comparing step.

4. The training method of claim 3, wherein said reporting step includes storing the information that is based on results of said comparing step.

5. The training method of claim 3, wherein said reporting step includes displaying the information that is based on results of said comparing step.

6. The training method of claim 3 further comprising:

second presenting of the same series of events at paced, defined time intervals;

second evaluating characteristics of each event of the series to produce an evaluation of each event;

second entering such evaluations at a data entry station; and

second storing such evaluations entered at the data entry station to produce the second dataset which is associated with the series of events.

7. The training method of claim 6, wherein said first presenting, first evaluating, first entering and first storing steps occur before said second presenting, second evaluating, second entering and second storing steps.

8. The training method of claim 6, wherein said first presenting, first evaluating, first entering and first storing steps occur after said second presenting, second evaluating, second entering and second storing steps.

9. The training method of claim 6, wherein said first presenting, first evaluating, first entering and first storing steps occur substantially concurrently with said second presenting, second evaluating, second entering and second storing steps.

10. A paced iterative decision training system comprising:

a presentation system for presenting a series of events at paced, defined time intervals;

an entry device operatively connected to said presentation system, said entry device configured for a user to enter an evaluation of characteristics of each event of the series;

a storage device operatively connected to said entry device for storing such evaluations to produce a first dataset which is associated with the series of events;

a comparator operatively connected to said storage device, said comparator configured to compare such first dataset with a second dataset, wherein the second dataset includes evaluations of the same series of events; and

a display system operatively connected to said comparator, said display system being configured to provide information based on said comparator's comparison of the first and second datasets.

11. The training system of claim 10, wherein said presentation system includes a video display operatively connected to a video reproduction system, wherein the video reproduction system generates visual images of the series of events from a prerecorded video medium, the series of events being stored on the prerecorded video medium.

12. The training system of claim 10, wherein said presentation system includes a video display operatively connected to a graphics computer system, wherein the graphics computer system generates computer-generated visual images of the series of events.

13. The training system of claim 10, wherein the storage device stores information based on said comparator's comparison of the first and second datasets.

14. A paced iterative decision training system for developing or honing the skill of a user who must make quick decisions regarding a series of events, wherein each event appears before the user at paced, defined time intervals, training system comprising:

a presentation system for presenting the series of events;

an input device associated with said presentation system, wherein the user enters evaluations of each of the events via said input device;

a recording system associated with said presentation system and said input system, said recording system recording each evaluation such that a first dataset is produced;

a comparison processor for comparing the first dataset with a second dataset, wherein the second dataset includes evaluation of the same series of events and said comparison processor is associated with said recording system; and

a storage system for storing information based on results produced by said comparison processor upon comparing the first and second datasets, wherein said storage system is associated with said comparison processor.

15. The training system of claim 14 further comprising a display system associated with said storage system, wherein said display system presents the information which is stored in said storage system.

16. The training system of claim 14, wherein said presentation system includes a video display operatively connected to a video reproduction system, wherein the video reproduction system generates visual images of the series of events from a prerecorded video medium, the series of events being stored on the prerecorded video medium.

17. The training system of claim 14, wherein said presentation system includes a video display operatively connected to a graphics computer system, wherein the graphics computer system generates computer-generated visual images of the series of events.

18. A paced iterative lumber-grading training method for developing and/or honing the skill of a lumber grader who quickly grades pieces of lumber traveling seriatim on a conveyer system at a substantially regular pace, lumber-grading training method comprising:

presenting to the user pieces of lumber traveling seriatim;

grading each piece of lumber as each is presented to the grader;

entering a grade for each piece;

recording the grades of the pieces of lumber such that a first dataset is produced;

comparing the first dataset with a second dataset, wherein the second dataset includes grades of the same pieces of lumber; and

reporting information based on results produced by said comparing step.

19. A paced iterative lumber-grading training system for developing and/or honing the skill of a lumber grader who must quickly grade pieces of lumber traveling seriatim on a conveyer system at substantially regular pace, lumber-grading training system comprising:

a presentation system for presenting the pieces of lumber traveling seriatim;

an input device associated with said presentation system, wherein the grader enters a grade for each piece via said input device;

a recording system associated with said presentation system and said input system, said recording system recording grades of pieces of lumber such that a first dataset is produced;

a comparison processor for comparing the first dataset with a second dataset, wherein the second dataset includes grades of the same pieces of lumber said comparison processor is associated with said recording system; and

a storage system for storing information based on results produced by said comparison processor upon comparing the first and second datasets, wherein said storage system is associated with said comparison processor.

20. The lumber-grading training system of claim 19 further comprising a display system associated with said storage system, wherein said display system presents the information which is stored in said storage system.

21. The lumber-grading training system of claim 19, wherein said presentation system includes a video display operatively connected to a video reproduction system, wherein the video reproduction system generates visual images of the pieces of lumber traveling seriatim from a prerecorded video medium.

22. The lumber-grading training system of claim 19, wherein said presentation system includes a video display operatively connected to a graphics computer system, wherein the graphics computer system generates computer-generated visual images of the pieces of lumber traveling seriatim.

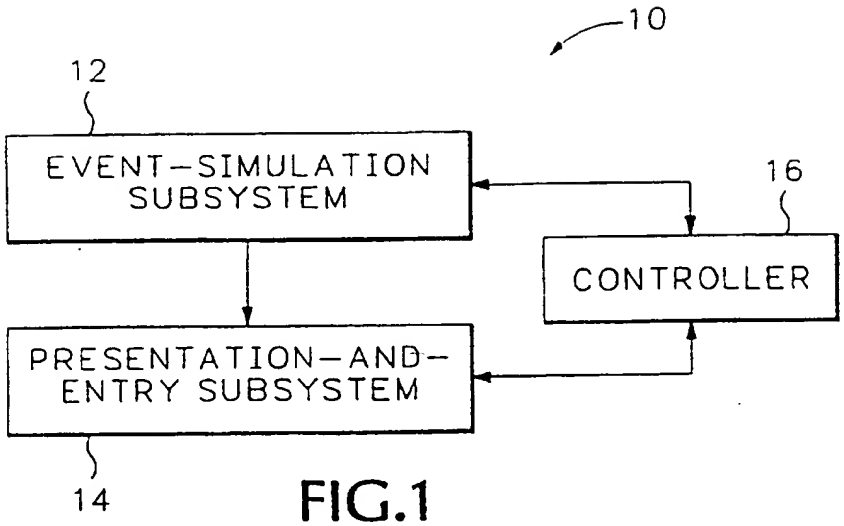

10
12
EVENT-SIMULATION SUBSYSTEM
16
CONTROLLER
PRESENTATION-AND-ENTRY SUBSYSTEM
14

FIG.1

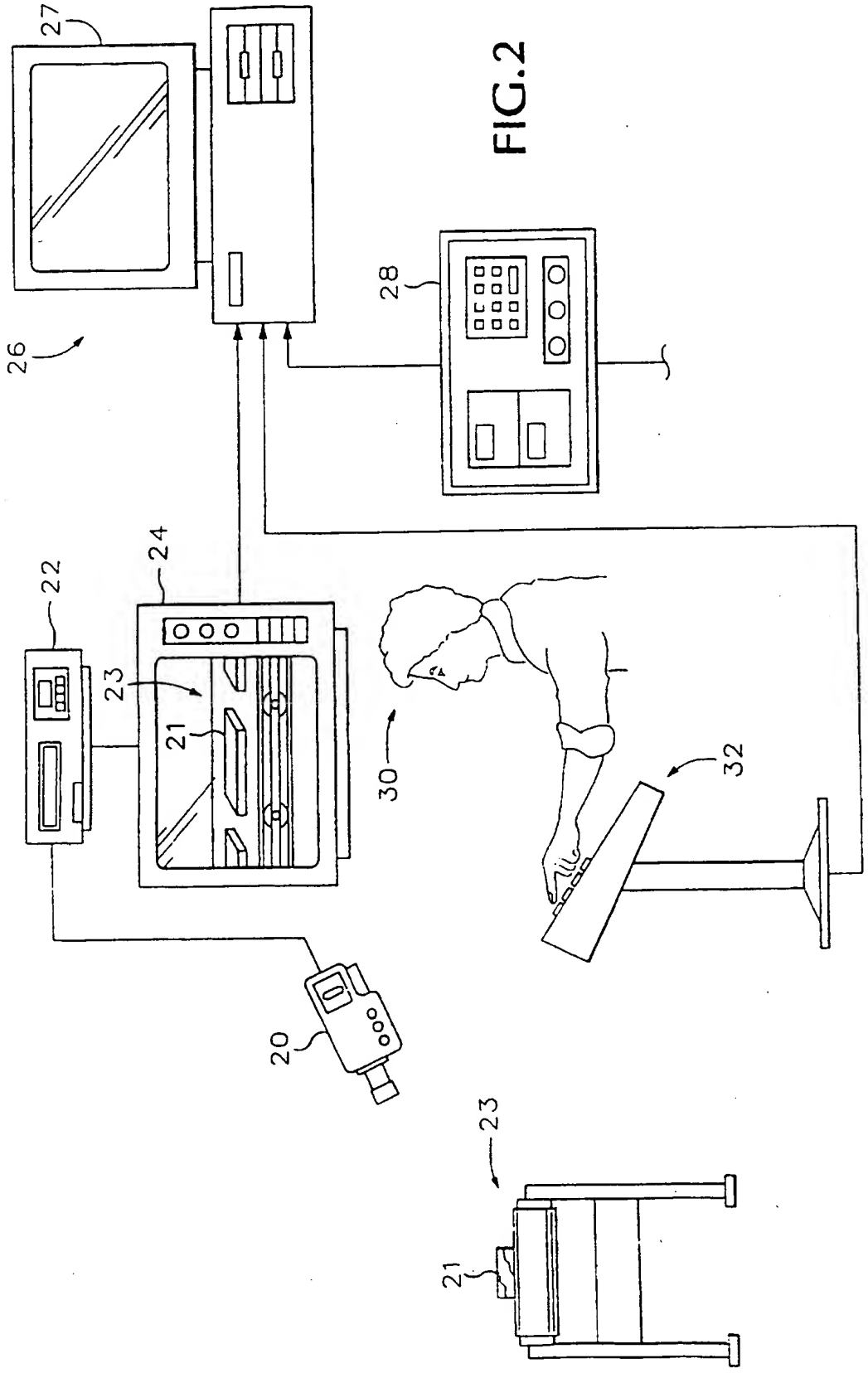


FIG.2

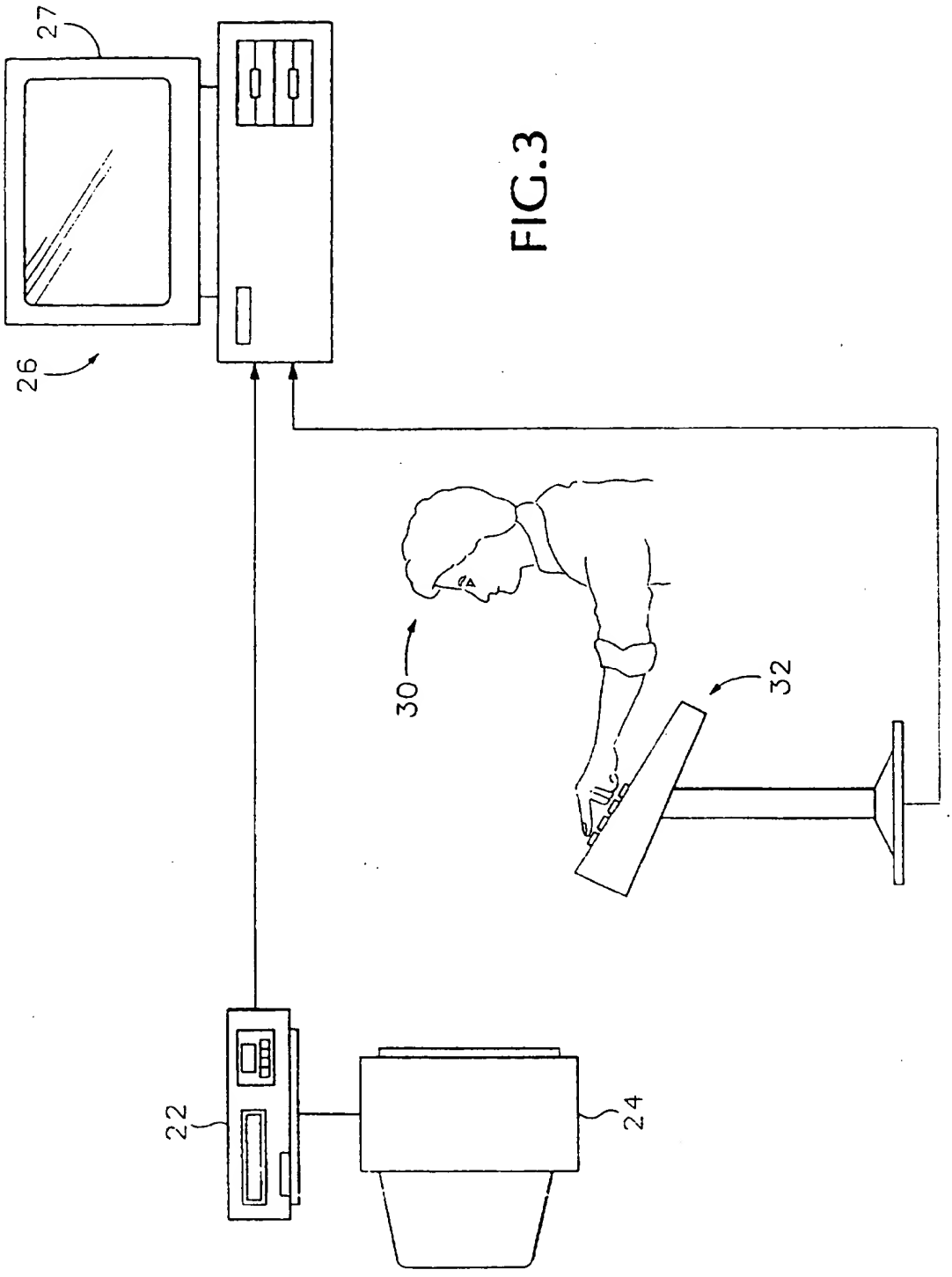
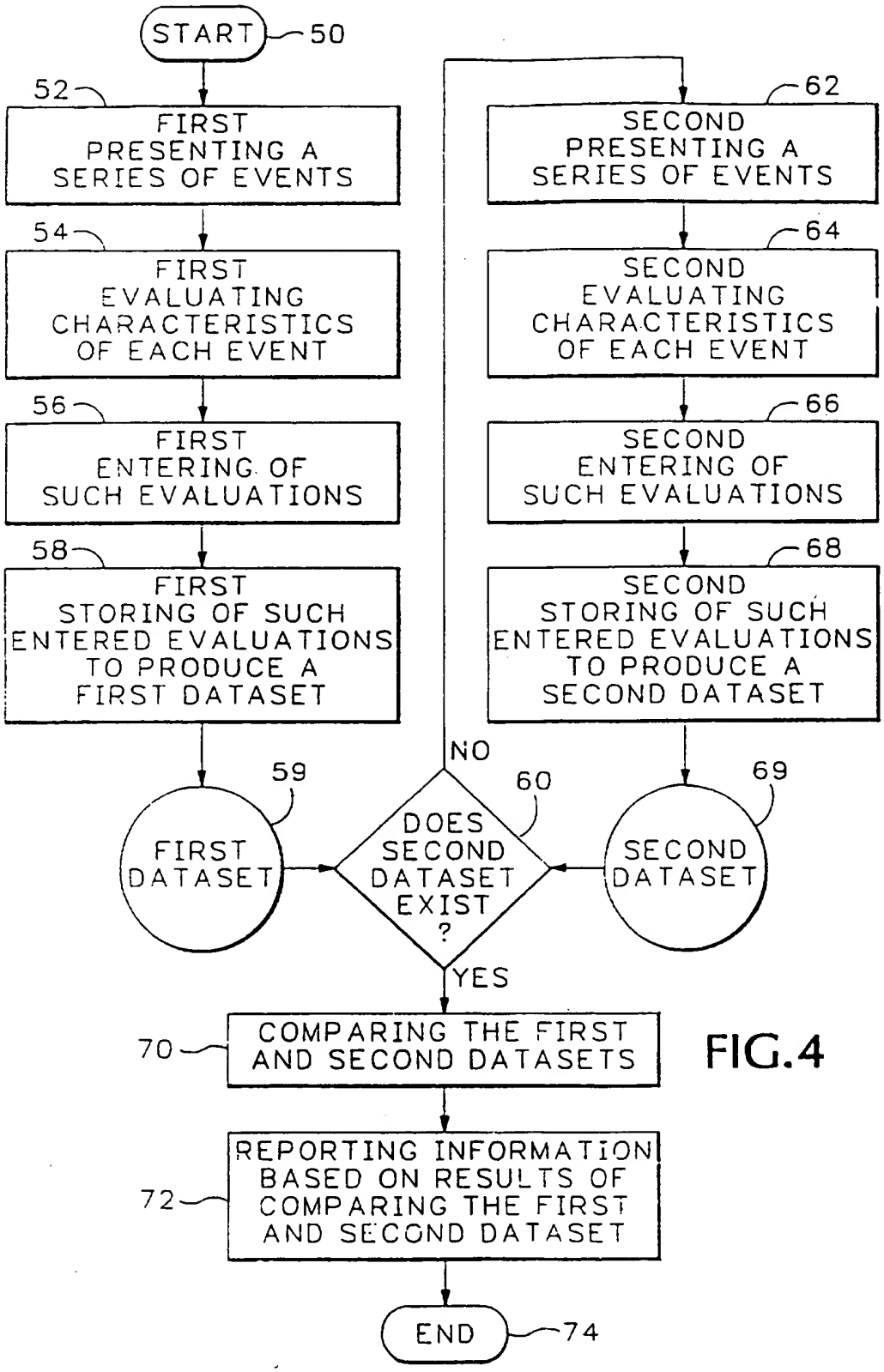


FIG.3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50
52
FIRST PRESENTING A SERIES OF EVENTS
54
FIRST EVALUATING CHARACTERISTICS OF EACH EVENT
56
FIRST ENTERING OF SUCH EVALUATIONS
58
FIRST STORING OF SUCH ENTERED EVALUATIONS TO PRODUCE A FIRST DATASET
62
SECOND PRESENTING A SERIES OF EVENTS
64
SECOND EVALUATING CHARACTERISTICS OF EACH EVENT
66
SECOND ENTERING OF SUCH EVALUATIONS
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SECOND STORING OF SUCH ENTERED EVALUATIONS TO PRODUCE A SECOND DATASET
59
FIRST DATASET
60
DOES SECOND DATASET EXIST ?
NO
YES
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COMPARING THE FIRST AND SECOND DATASETS
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REPORTING INFORMATION BASED ON RESULTS OF COMPARING THE FIRST AND SECOND DATASET
END
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FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/19664

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G09B 7/00
US CL :434/323

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,344,324 A (O'DONNELL et al) 06 September 1994, Figs. 1-8.	1-17 --- 18-22
X --- Y	US 5,321,611 A (CLARK et al) 14 June, 1994, Figs. 1-13.	1-17 --- 18-22
Y	US 4,992,949 A (ARDEN) 12 February 1991, Figs. 1-8.	1-22
Y	US 5,376,007 A (ZIRM) 27 December 1994, Figs. 1-4.	1-22
A	US 5,306,154 A (UJITA et al) 26 April 1994, Figs. 1-20.	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

209/518, 582; 250/559.46; 348/95, 552; 356/237; 364/474.09, 478.11, 550; 382/110; 434/118, 219, 238, 252, 258, 307R, 322, 323, 350, 362, 365